भारतीय मानक

IS 1448 (Part 66) : 2023

Indian Standard

पेट्रोलियम और उसके उत्पाद — परीक्षण पद्धतियाँ

भाग 66 संशोधित पेन्सकी-मार्टिन उपकरण द्वारा फ़्लैश पॉइंट (खुला) और अग्नि बिंदु

(पहला पुनरीक्षण)

Petroleum and Its Products — Methods of Test

Part 66 Flash Point (Open) and Fire Point by Modified Pensky-Martens Apparatus

(First Revision)

ICS 75.080

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BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

September 2023 **Price Group 4**

Methods for Sampling and Test for Petroleum and Related Products of Natural or Synthetic Origin (Excluding Bitumen) Sectional Committee, PCD 01

FOREWORD

This Indian Standard (Part 66) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Methods for Sampling and Test for Petroleum and Related Products of Natural or Synthetic Origin (Excluding Bitumen) Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council

This standard was originally published in 1969 and was based on IP 35/63. The first revision has been brought out to keep pace with the latest technological developments and international practices. In this revision following major changes have been made:

a) The scope has been modified to make it applicable to paints and varnishes as well;
b) Material, Calculation and Reference clauses have been incorporated; and
c) Apparatus, Procedure and Reporting clauses have been updated.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'.

Indian Standard

PETROLEUM AND ITS PRODUCTS — METHODS OF TEST

PART 66 FLASH POINT (OPEN) AND FIRE POINT BY MODIFIED PENSKY-MARTENS APPARATUS

(First Revision)

1 SCOPE

This standard prescribes the method of test for the determination of the open cup flash point and the fire point of petroleum products, paints and varnishes which have open cup flash point in the range of 40 °C to 370 °C.

2 REFERENCE

The standard given below contains provisions which, through reference in this text, constitutes provisions of this standard. At the time of publication, the edition indicated was valid. All standard is subject to revision, and parties to agreements based on this standard is encouraged to investigate the possibility of applying the most recent edition of this standard:

IS No.	*Title*
IS 1448 (Part 21) : 2019/ISO 2719 : 2016	Methods of test for petroleum and its products: Part 21 Determination of flash point — Pensky-Martens closed cup method (*fourth revision*)

3 OUTLINE OF THE METHOD

The sample is placed in the cup of the modified Pensky-Martens apparatus [*see* IS 1448 (Part 21)] and heated at a specified rate. A small test flame is directed on the cup. The flash point is taken as the lowest temperature at which the test flame causes the vapour above the sample to give a momentary distinct flash. The fire point is taken as the temperature at which the oil gets ignited and continues to burn for at least 5 s.

4 MATERIAL

4.1 Cleaning Solvent

For removal of traces of sample from the test cup and clip. The choice of the solvent will depend upon the previous material tested and the tenacity of the residue. Low volatility aromatic solvents (benzene free) may be used to remove traces of oil. Solvent mixtures such as toluene-acetone-methanol can be effective for the removal of gum type deposits.

5 APPARATUS

5.1 Standard Pensky-Martens Tester — conforming to the requirements prescribed in IS 1448 (Part 21) with the modifications described in **5.1.1**. The thermometer prescribed in **5.3** shall be used.

5.1.1 The cover of the cup shall be replaced by a clip which encircles the upper rim of the cup and carries the thermometer and test flame. The tube carrying the thermometer shall have its centre on a radius at approximately 90^0 to the radius passing through the point of attachment of the test flame, and shall be of such a height that when the thermometer is in position its bulb shall be in the vertical axis of the cup and 13 mm below the filling line. The test flame shall be fixed at the vertical axis of the cup and at a level with the upper edge of the cup.

5.1.2 *Cleaning the Test Cup*

Wash the test cup, cover and its accessories with an appropriate cleaning solvent (*see* **4.1**), to remove any traces of gum or residue remaining from a previous test. Dry using a stream of clean air to ensure complete removal of the solvent used.

5.1.3 *Location of the Apparatus*

5.1.3.1 Support the flash point apparatus on a level and steady surface in a draught-free position. Refer Fig. mentioned in Annex B of IS 1448 (Part 21).

NOTE — When draughts cannot be avoided, it is good practice to surround the apparatus with a shield.

5.1.3.2 The flash point apparatus may be located in a fume hood with individual air flow control, adjusted so that vapours can be withdrawn without causing air currents around the test cup during the test.

5.2 Barometer — absolute pressure reading, accuracy of ± 0.5 kPa and with a resolution of 0.1 kPa.

NOTE — Barometers pre-corrected to give sea level readings, such as those used at weather stations and airports, shall not be used.

5.3 Temperature measuring devices meeting requirements as mentioned on next page.

Sl No. *(1)*	*Characteristics* *(2)*	*Low Range* *(3)*	*High Range* *(4)*
i)	Range	-7 ºC to + 110 ºC	90 ºC to 370 ºC
ii)	Graduation	0.5 ºC	2 ºC
iii)	Immersion	57 mm	57 mm
iv)	Overall length	280 mm ± 10 mm	280 mm ± 10 mm
v)	Stem diameter	5.5 mm to 8.0 mm	5.5 mm to 8 0 mm
vi)	Bulb shape	Cylindrical	Cylindrical
vii)	Bulb length	9 mm to 13 mm	10 mm , *Max*
viii)	Bulb diameter	Not less than 5.5 mm and not greater than stem	Not less than 5.5 mm and not greater than stem
ix)	Length of graduated portion	143 mm to 177 mm	143 mm to 177 mm
x)	Distance, bottom of bulb to lowest graduation	75 mm to 90 mm	75 to 90 mm
xi)	Longer lines at each	1 ºC and 5 ºC	10 ºC and 20 ºC
xii)	Figured at each	5 ºC	20 ºC
xiii)	Expansion chamber	Required	Required
xiv)	Top finish	Ring to button	Ring to button
xv)	Scale error not to exceed	± 0.5 ºC	Up to 260 ºC : ± 1 ºC Above 260 ºC : ± 2 ºC

6 PROCEDURE

6.1 The test shall be made in a room or compartment, free from draughts, and sufficiently darkfor the flash to be readily discernible.

6.2 Thoroughly clean and dry all parts of the cup and its accessories before starting the test. Take particular care to remove the traces of any solvent used to clean the apparatus.

6.3 Fill the cup with the sample to be tested, up to the level indicated by the filling mark.

6.4 Place the clip carrying the thermometer and test flame on the cup and set the latter in the stove. Take care that the locking devices are properly engaged. Insert the thermometer; if it is known that the oil will flash above 105 ºC, use the high range thermometer, otherwise it is preferable to start with the low range thermometer and change to the high range thermometer when the temperature reaches 100 ºC to 105 ºC. Ensure that the thermometer bulb is completely immersed so that it is 13 mm below the surface of the liquid.

6.5 Light the test flame and adjust the flame size to reference bead size (4 mm in diameter).

6.6 Apply heat at such a rate that the temperature recorded by the thermometer increases not less than 5 ºC nor more than 6 ºC per min and observe the surface of the oil carefully.

6.7 When the test portion is expected to have a flash point up to 110 ºC or below, apply the ignition source at 18 ºC below the expected flash point and observe carefully at every 1 ºC intervals. The test flame is applied in one direction with a smooth continuous motion taking approximately 1 s to travel in one direction passing through the centre of the cup, either through a straight line or through the circumference of a circle of at least 100 mm radius. The centre of the flame shall move in horizontal plane not more than 2 mm above the plane of the upper edge of the test cup. For the next test flame application, pass the flame in the opposite direction.

6.8 When the test portion is expected to have a flash point of above 110 ºC, make the first application of the ignition source when the temperature of the test portion is 23 ºC ± 5 ºC below theexpected flash point and thereafter at temperatures which are multiple of 2 ºC.

6.9 Care should be taken when testing samples that contain significant amounts of water phaseas heating of these samples can cause them to foam and eject from the test cup to the heated surface of apparatus.

6.10 As a safety practice, it is strongly advised to apply the ignition source to test portion in the cup before heating the test cup and test portion, to check for the presence of unexpected volatile matter. For an expected flash point above 66 ºC , apply the ignition source every 10 ºC throughout the test until the sample temperature reaches 28 ºC below the expected flash point and then follow the prescribed method of application of ignition source as per **6.6** to **6.8**. Thispractice reduces the possibility of a fire without significantly affecting the result.

6.11 When a flash point is detected on the first application itself, the test shall be discontinuedand the test shall be repeated with a fresh test portion. When the temperature at which the flash point is detected is less than 18 ºC or greater than 28 ºC from the temperature of first application the ignition source, the result shall be considered approximate. Repeat the test using a fresh test portion, adjusting the temperature of the first application of the ignition source until a valid determination is obtained.

6.12 Record the flash point and/or fire point (as defined in **3**) to the nearest resolution of the thermometer (1 ºC or 2 ºC as applicable). No correction shall be applied for the exposed mercury thread.

6.13 At the end of the test, when the apparatus has cooled down to a safe handling temperature, remove the clip, test cup and clean the apparatus and cup of the residues.

7 CALCULATION

7.1 Conversion of Barometric Pressure Reading

If the barometric pressure reading is measured in a unit other than kilopascals, convert to kilopascals using one of the following conversions:

a) Reading in hPa × 0.1 = kPa;
b) Reading in mBar × 0.1 = kPa; and
c) Reading in mmHg × 0.1 333 = kPa.

7.2 Correction of Observed Flash Point to Standard Atmospheric Pressure

Calculate the corrected flash point, T_C, using formula:

$$T_c = T_d + 0.25 \times (101.3 - p)$$

where

T_d = detected flash point, in ºC;
p = absolute barometric pressure, in kPa;
0.25 is a constant, ºC/kPa; and

101.3 is used as the standard atmospheric pressure, in kPa.

NOTE — The above formula has been proven for barometric pressure down to 82.0 kPa, and is strictly correct only up to 104.7 kPa

8 REPORTING

Report the result as open cup flash point or open cup fire Point, IS 1448 (Part 66) corrected to standard atmospheric pressure and rounded off to nearest 1ºC.

9 PRECISION

Precision statements for acceptability of results at 95 percent confidence limits are stated below:

Sl No. (1)	*Determination* (2)	*Repeatability* (3)	*Reproducibility* (4)
i)	Flash point (open)	8 ºC	11 ºC
ii)	Fire point	8 ºC	14 ºC

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Methods for Sampling and Test for Petroleum and Related Products of Natural or Synthetic Origin (Excluding Bitumen) Sectional Committee, PCD 01

Organization	*Representative(s)*
Indian Institute of Petroleum, Dehradun	Dr Anjan Ray **(*Chairperson*)**
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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
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